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Report of the Workshop on the evaluation of the long-term management plan for North Sea herring [WKHERMP].

14 – 15 March 2011

ICES Headquarters, Copenhagen

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CIEM Conseil International pour l'Exploration de la Mer

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Executive summary

The workshop on the evaluation of the long-term management plan for North Sea herring [WKHERMP] was set up by ICES to answer a request from the EU and Norway on the future of the management plan for North Sea autumn spawning herring. There were nine participants of the workshop that took place in March 2011. The approach of WKHERMP was one of a qualitative assessment of the questions from EU/Norway within the framework of the herring assessment working group and the previous investigations of the North Sea herring management plan (e.g. WKHMP which met in 2008). All of the considerations were carried out within a single stock and single species approach and did not consider multispecies interactions or the role of herring within the North Sea ecosystem.

WKHERMP found no substantive changes to the biology or ecology of herring to suggest that the simulations from WKHMP 2008 were no longer applicable (recruitment, growth, maturity, migrations). Although the fishing behaviour of some fleets may have recently altered, these potential changes were judged unlikely to impact on other aspects of the management plan. The quality of the stock assessment may have changed in recent years. This change in quality could have implications in terms of understanding the signal to noise ratio from the assessment and the functioning of the simulations of the management plan.

The management plan was evaluated. The management plan appears to operate well in relation to the objectives of consistency with the precautionary approach and a rational exploitation pattern, but not in relation to achieving stable and high yield. The main weakness appears to be the 15% IAV limit on TAC change which leads to unnecessarily restricted TACs when the stock is improving.

A scientific analysis of B_{pa} should be carried out. Although it is no longer used for management considerations nor part of the management plan, B_{pa} is widely used in the classification of the stock status thus it is important to the industry.

The current $F_{2\text{-}6}$ of 0.25 is consistent with the MSY approach under the current low recruitment regime. The management plan is also considered consistent with the MSY approach, although the trade-off between stability and high yield will limit the maximising of yield in some circumstances.

There is no basis to further adjust the harvest control rule to account for recruitment variability or trends.

In view of the exceptional increase in the estimated SSB in 2010, WKHERMP noted that it was better to have a management plan that is able to be responsive to large changes in the biology of the stock, or assessment uncertainty, than mechanisms for within-year revisions within the management plan.

WKHERMP suggests that further work on the management plan be carried out in 2011, prior to the December decisions by the EU and Norway, to develop mechanisms that avoid the unwanted side-effects of the present plan. This work cannot be carried out during the 2011 herring assessment working group.

1 Introduction

The workshop on the evaluation of the long-term management plan for North Sea herring [WKHERMP] was set up by ICES (Annex 1) to help ACOM answer a request from the EU and Norway (Annex 2) on the future of the management plan for North Sea autumn spawning herring. There were nine participants of the workshop (Annex 4) that took place in March 2011. The approach of WKHERMP was one of a qualitative assessment of the questions from EU/Norway within the framework of the herring assessment working group and the previous investigations of the North Sea herring management plan (e.g. WKHMP which met in 2008). All of the considerations were carried out within a single stock and single species approach and did not consider multispecies interactions or the role of herring within the North Sea ecosystem.

2 Background to WKHERMP

The current management plan is the result of a process that began in the mid-1990s. Any consideration of the plan needs to be made within the context of this process and the on-going developments in the ICES advice. Thus this section puts the new request into the context of the last 15 years of development and the recent approaches used by ICES.

2.1 A brief history of the North Sea Herring Management Plan.

The origin of the present management plan stemmed from negotiations between the EU and Norway in 1997. The background for this development was the imminent stock collapse that was recognized in 1996 and led, following the advice from ICES, to a drastic reduction in the catches in the middle of 1996. The key elements in this plan were a fishing mortality set separately for adult and juvenile herring (at 0.25 and 0.12 respectively) and a trigger biomass (1.3 million tonnes) below which the fishing mortalities should be reduced. The target fishing mortalities were decided based on extensive simulations (Patterson et al., 1997) to find the level of sustainable exploitation of adults and juveniles that resulted in a low risk of bringing SSB below 800 000 tonnes, which was the MBAL at the time (Minimum Biological Acceptable Levels). The trigger biomass (1.3 MT) was decided mainly on political grounds, but it was also thought to give some protection against falling below the MBAL.

When the rule was decided the SSB was well below 1.3 million tonnes. The rule did not specify mortalities for that situation, but in practice the TACs set corresponded to an adult F of about 0.2. The industrial fishery on juvenile herring and sprat became heavily regulated and controlled, resulting in a fishing mortality around 0.05, well below the agreed level.

When ICES introduced precautionary reference points in its advisory practice, the MBAL level was adopted as B_{lim} and the trigger biomass of 1.3 million tonnes as B_{pa}. The target fishing mortalities in the harvest rule were adopted as F_{pa}.

The harvest rule was amended in 2004. The amendments included specific rules to apply when SSB is below 1.3 million tonnes and a constraint on TAC change from year to year.

ICES examined the performance of this revised harvest control rule in 2005 (ACFM 2005) and considered the target F to be consistent with the precautionary approach. However, ICES considered that the strict application of the TAC change limit of 15%

(rule number 5) may not be consistent with the precautionary approach. Assuming that paragraph 6 (reducing the TAC more than 15%) would be invoked when TAC constraints would lead to SSB falling below B_{pa}, the HCR (harvest control rule) was considered to be in accordance with the precautionary approach.

Previous evaluations of the rule were done assuming recruitment at the historical average. Since 2001, the recruitment has been at about half the long term average. There are no indications that this is just a temporary change in stock dynamics. Hence, ICES advised that management should adapt to a regime with reduced recruitment, and noted that the performance of the existing rule at the time was at best marginal in this situation, as it may break down if the assessment and/or implementation and compliance were sufficiently biased (ICES, 2005).

In 2008, following the analysis of WKHMP (ICES CM 2008 ACOM:27), the management plan was again amended in response to the reduced recruitment. The trigger biomass was raised to 1.5 million tonnes, thus reducing the target fishing mortality of the human consumption fishery when the SSB was between 0.8 and 1.5 million tonnes. The target fishing mortality on the juveniles was also reduced to 0.05 and 0.04 when below 0.8 million tonnes SSB. Also ICES agreed that the 15% annual limit on TAC change was now precautionary, as long as paragraph 6 also remained in the plan. The current plan (from 1 January 2009 to 31 December 2011, Annex 3) has thus been the basis for advice for North Sea autumn spawning herring (Figure 2.1).

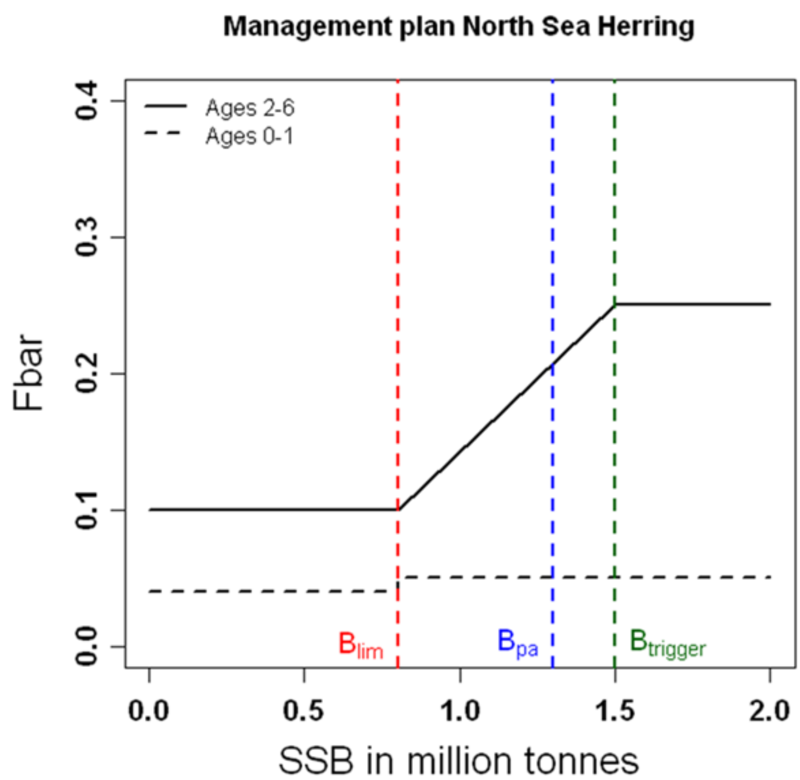


Figure 2.1. Summary of the current harvest control rule for North Sea herring (see Annex 4).

2.2 Assumptions about stock productivity (recruitment and growth).

2.2.1 Recruitment

The dynamic of any fish stock is largely dependent on the form of the relationship between spawning biomass and recruitment and, in terms of biomass, on the changes of the individual growth in the population and removals from that stock. Therefore, the specification of the assumed stock productivity at different stock sizes is crucial in simulations of management plans. Many different approaches for recruitment modelling have been used in the past, but without conspicuous success (Needle, 2002) and effective prediction of the central tendency and variability of future recruitment. Despite this, recruitment models are widely used because strategic fishery management demands an assessment of the likely future response of fish populations to exploitation. Medium-term (5- to 10-year) projections should be based on the best available data (usually the most up to date) but are also going to incorporate some assumptions about recruitment. A robust evaluation of any management plan is highly dependent on the specification of the recruitment algorithms used in the simulations. The key task for recruitment modelling is to characterise appropriately the probable variation in future recruitments and hence, the likely fluctuations in stock sizes under all feasible combinations of environmental conditions and fishing mortality (Needle, 2002).

In the last 50 years, the life stage at which recruitment strength of North Sea herring has been determined is the larval stage (Nash & Dickey-Collas, 2005; Payne *et al.*, 2009). Recent work suggests that the year class strength is determined in the first 20 days after hatch (Fässler *et al.*, in press). Work is on-going to further explain this variability; however, until we gain further insights, our assumptions about the dynamics and causes of the recruitment variability are based on the existing times series and our assumptions about the dynamics. The ICES SGRECVAP (2007) considered a range of recruitment relationships for North Sea herring, and further work within the EU projects INEXFISH, UNCOVER, RECLAIM and FACTS has also investigated this. SGRECVAP reported that there was no indication that the current series of poor recruitments was likely to change; this assumption is accepted by WKHERMP and by HAWG. It is clear that, depending on the time series used and the models fitted, the dynamics of the stock-recruitment relationship can be varied (Nash *et al.*, 2009), thus also the break points in the choice of recruitment model.

Compensation in recruitment has occurred in North Sea herring, and it was stronger after the collapse of the stock. The compensation appears to be a product of both increased production of larvae per spawner and increased survival to the juvenile stage (Nash *et al.*, 2009). There is more variability in recruits per unit spawning stock size when the stock is smaller; this is probably as a result of the potential larger diversity in contributions from spawning components in an unexploited stock compared to an overexploited stock (see Schmidt *et al.*, 2009). Mimicking this dynamic in population models will increase the uncertainties in a projection of stock recovery. The lack of observations at higher stock sizes hinders our ability to compare the dynamics of recruit to SSB across the full range of stock sizes. While it is clear that apparently stochastic environmental fluctuations will be the principal determinant of future recruitment variation (Groeger *et al.*, 2010), the underlying processes appear complex (Dickey-Collas *et al.*, 2010; Fässler *et al.*, in press). Brunel *et al.*, (2010) suggest that environmental harvest control rules (eHCRs) are beneficial when the environmental signal is strong and the environmental conditions are worsening, but in situations with little change, there is no appreciable benefit to developing eHCRs. The current

North Sea herring rule was adjusted in 2008 to account for the lower productivity of the stock and developing these eHCRs does require an underlying understanding of the processes, which currently are lacking.

2.2.2 Growth

Simulations of future productivity must also include assumptions about growth (Brander, 2003; 2010). There is evidence for changes in the growth of North Sea herring. In populations experiencing large changes in abundance, density-dependent regulation of growth might occur, because of reduced competition for food when stock size is smaller (Melvin and Stephenson, 2007). Before and during the collapse (from the late 1940s to the early 1980s), length-at-age increased markedly (approx 2 cm at age 3) for the Orkney/Shetland, Banks, and Downs components (Dickey-Collas *et al.*, 2010). Although there was no relationship with stock biomass for the Orkney/Shetland component, the increase in length-at-age was negatively correlated with the changes in stock biomass in the Banks and Downs components, suggesting a density-dependent effect. During the period of stock recovery, weight-at-age decreased and these declines were correlated significantly and inversely with stock size in Downs herring (Shin and Rochet, 1998). More generally, strong herring year classes have grown poorly in recent years, suggesting that density-dependent mechanisms are operating.

Whereas most of the variations in size-at-age observed can be explained by density-dependent mechanisms, there are also indications of environmental effects. Modelling the growth of juvenile herring during the period of stock decline (1961–1981), Heath et al. (1997) explained the interannual variability in growth rate (superimposed on the main trend of density-dependent growth) by environmental fluctuations (hydrographic conditions and plankton abundance). Shin and Rochet (1998) found that, in addition to effects of stock size, growth in Downs herring was affected by wind-induced turbulence in spring (through its effects on intensity and timing of plankton blooms). For juvenile and adult life stages, a meta-analysis of the effect of temperature and density-dependence on the growth rates of 15 North Atlantic herring stocks by Brunel and Dickey-Collas (2010) established that temperature significantly explained variations in growth between cohorts of North Sea herring from the mid-1980s. Cohorts experiencing warmer conditions throughout their lifetime attained higher growth rates, but had a shorter life expectancy and smaller asymptotic size. There is, however, no current model to disentangle the various causes of variability in historical growth. Thus WKHERMP does not have the ability to combine developments in our understanding about growth into further simulations of the harvest control rule.

2.3 Precautionary reference points and management plans considered precautionary

The 1998 Study Group on the Precautionary Approach to Fisheries Management (ICES, 1998) estimated reference point values that were adopted by ACFM in giving advice (ICES, 1999). This framework was developed after the adoption of the first harvest rule (management plan) for herring. ICES has also moved the basis for its advice to MSY concepts, but the precautionary approach should still be included in the considerations of advice, thus here we explain the ICES interpretation of the precautionary approach.

Conceptually, precautionary reference points (PA) are different from parameters in a harvest control rule. In the PA approach, as interpreted by ICES, the function of the reference points is to ensure that the SSB is above the range where recruitment may be impaired or the stock dynamics is unknown. The limit is represented by B_{lim}, while the B_{pa} takes assessment uncertainty into account, so that if SSB is estimated at B_{pa}, the probability that it really is below B_{lim} shall be small. In the MSY approach, ICES will currently maintain the concept of a precautionary biomass. However the limit values of F under the precautionary approach will be replaced by FMSY targets.

In a harvest rule, parameters serve as guidance to actions according to the state of the stock (ICES Study Group on the Precautionary Approach 2002). These should be chosen according to management objectives, one of which should be to have a low risk of bringing the SSB to unacceptably low levels. In the evaluation of a harvest rule, one will use simulations with a 'real stock' which as far as possible resembles the stock in question, and the risk is evaluated as the probability of the 'real' SSB being below the B_{lim} value. Within the constraints needed to keep the risk to B_{lim} low, parameters of the rule will be chosen to serve other management objectives, e.g. to ensure a high long term yield and stable catches over time. ICES has accepted that a harvest rule as such is in accordance with the precautionary approach as long as it implies a low risk to B_{lim}, even if other reference points may be exceeded occasionally. When a rule is regarded as precautionary, and the rule is followed, ICES gives its advice according to the rule. Within this framework, other precautionary reference points generally will be redundant. However, the precautionary reference points are also used to classify the stock with respect to 'safe biological limits', which may lead to a conflict that is still unresolved.

For the North Sea herring, the B_{lim} was set at a level below which the recruitment may become impaired. The other precautionary reference points (Fpa and Bpa) were taken from the already existing harvest rule, which in turn may have been political in origin. The target fishing mortalities there were intended as targets and not as upper bounds. The initial inflection point in the rule (1.3 million tonnes) was derived largely as a political compromise, reflecting an ambition to maintain the stock at a high level, by reducing the fishing mortality at an early stage of decline. The current inflection point (1.5 million tonnes) was also partly political in nature as WKHMP (2008) gave a range of possible mechanisms to the stakeholders to reduce fishing mortality, and they chose increasing the inflection point. Neither the 1.3 or 1.5 million tonne SSB inflection point reflects a quantitatively assessed estimate of B_{pa}.

2.4 The management plan at the MSY approach

Like HAWG, WKHERMP interprets FMSY as a value of F that is expected to lead to a near maximum yield in the long term. For most stocks, there will be a lower bound where long term yield is lost because of low exploitation and an upper bound where there is an increasing risk of recruitment impairment. Within that range, there may sometimes be a distinct maximum, depending on selection-at-age, growth rate and natural mortality. The pattern may be modified if growth and maturity are density-dependent, or if the natural mortality is sensitive to multispecies effects.

For most herring stocks, which typically are lightly exploited at small size and young age, there is no distinct maximum. Hence, the highest long term yield may be expected at a fishing mortality which is close to that leading to recruitment failure. The lower bound may be represented by F0.1, but in some cases F0.1 may be higher than the mortality leading to impaired recruitment. Hence, the most rational target fishing mortality may be one where the loss is small, and which is safely away from the region where the recruitment may be impaired.

WKHERMP regards the development of management plans as the way forward to a rational utilisation of the resources. Too strong an emphasis on specific values for an FMSY using common proxies may hamper the development of good management plans.

Management plans typically have the objective to ensure 'a high yield' or a 'maximum sustainable yield' within the framework of the precautionary approach. In the development of such plans, extensive studies have often been made that also considered maximum yield under various productivity regimes. Hence, they are reconciled with the MSY objective. Management plans may sacrifice some long term yield to achieve other objectives, like stability. A possible criterion with respect to MSY may be that the management plan can be expected to lead to an effective fishing mortality within the range that should lead to a near maximum long term yield, taking into account likely errors in assessment and implementation.

2.5 The Impact of WKWATSUP

The Workshop on procedures to establish the appropriate level of the mixed herring TAC (Spring Western Baltic (WBSS) and Autumn Spawning North Sea (NSAS) stocks) in Skagerrak and Kattegat (Division IIIa) met in November 2010 (ICES CM 2010/ACOM:64). The overall outcome of WKWATSUP was an alternative TAC setting procedure to the procedures suggested by the joint request from the EC Commission and Norway. The WKWATSUP suggest that for the IIIa area, the TAC for western Baltic spring spawners should first be set for the WBSS according to the FMSY or FMSY transition framework for WBSS alone. NSAS stock dynamics should currently not play a role in the determination of the TAC for Division IIIa. If the NSAS is greatly impacted by management of the WBSS, this rule needs to be re-evaluated. See comments by WKFRAME2 in section 2.6.

2.6 The Impact of WKFRAME 2

The second Workshop on Implementing the ICES FMSY Framework (WKFRAME-2 ICES CM 2011/ACOM:33) met in January 2011 to provide further technical guidelines to assist ICES expert groups in the implementation of the ICES MSY framework for advice which was introduced in 2010. In 2010 confusion arose as to what ICES was advising in relation to sustainable harvest rates, in situations where there were technical differences between fishing at a defined FMSY and according to an accepted management plan. WKFRAME 2 clarified this issue and it is ICES policy to have a hierarchical approach to advice, where agreed management plans will be the primary consideration.

WKFRAME 2 noted that HAWG did not consider candidate values for a $B_{trigger}$ in great detail. HAWG considered that there is a range of biologically appropriate biomass triggers that are possible for each stock (see sections 2.1 and 2.3 for comments on the rationale for the biomass trigger points). The final choice will most likely be made based on management plan development. WKFRAME noted that HAWG regards the development of management plans as the way forward to a rational utilisation of the resources, and is concerned that too strong an emphasis on specific values for FMSY proxies or BMSY may hamper the development of good management plans.

WKFRAME commented that the introduction of a hierarchical approach to advice, giving primacy to implemented management plans, should solve any issues in relation to advice provision where there is a management plan. The mixed fisheries issue in relation to the WBSS-NSAS complex is not solvable from a purely scientific perspective. The decision to provide TAC advice on the basis of not overexploiting the weakest stock (in the mixed fishery) is a policy decision, and it should remain transparent as such.

3 Changes to the fishery and stock since 2008

3.1 Recruitment

WKHMP met in February 2008. The recruitment time series available at the time extended to and included the 2005 year class. At the WKHERMP (March 2011) the time series has been extended to the 2008 year class so it is appropriate to examine any possible changes to the available data.

There are two recruitment indices available for North Sea autumn spawning herring, the IBTS-0 and the IBTS-1, produced from surveys of 0-group and 1-group herring in quarter 1 each year.

The relationship between the two indices, comparing year classes, is very close (Figure 3.1.1). However, in the most recent years (year classes 2006, 2007 and 2008) this relationship has become decoupled (Figure 3.1.2) with the two indices giving conflicting information on recruitment for the year classes 2006, 2007 and 2008. The recruitment time series produced in the annual stock assessment integrates the survey indices with the catch data and therefore provides a more robust estimate of recruitment (Figure 3.1.3). **For the most recent three year classes there is no evidence that recruitment has either increased or decreased and there is no reason therefore to change the assumption that NS herring recruitment is still in the current low productivity phase.**

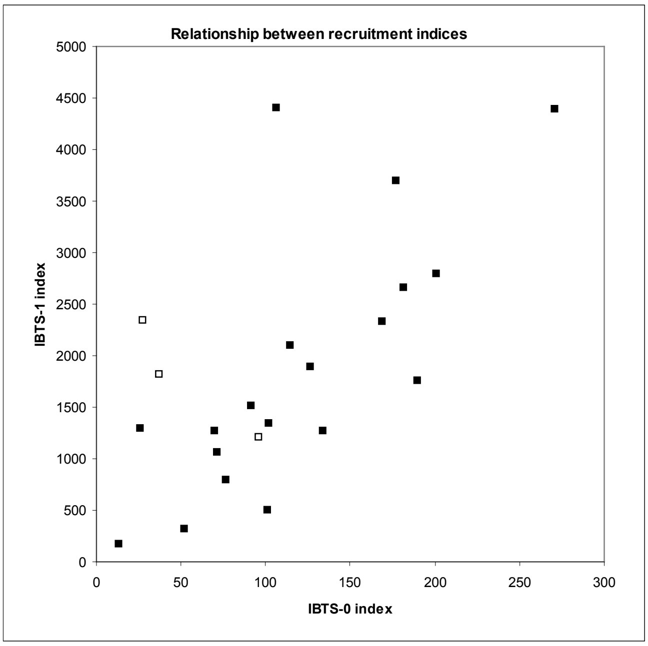


Figure 3.1.1. Relationship between North Sea herring indices of 0-ringers and 1-ringers for year classes 1977 to 2008. Filled squares year classes 1977 to 2005; open squares 2006 to 2008.

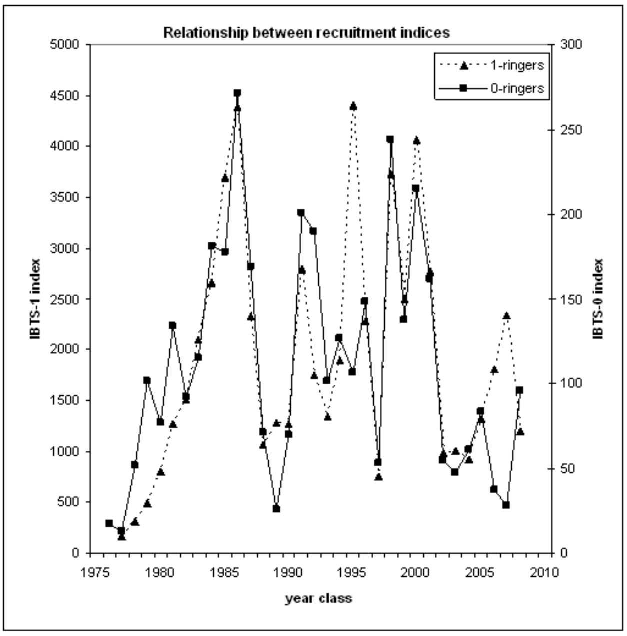


Figure 3.1.2. Time series of North Sea herring IBTS 0-ringer and 1-ringer indices. Year classes 1976 to 2009 for 0-ringers, year classes 1977 to 2008 for 1-ringers.

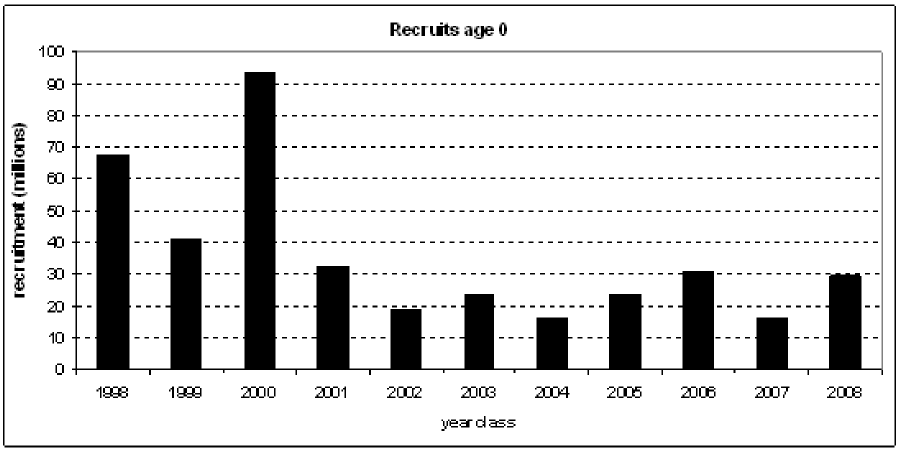


Figure 3.1.3. Recruitment time series (age 0), for the 1998 to 2008 year classes, from the FLICA assessment of North Sea herring in 2010.

3.2 Growth

WKHERMP investigated whether the growth in recent years had differed significantly from the growth observed since the implementation of the Long Term Management Plan (LTMP) in 1996. Therefore, we tested if the stock weight-at-age has changed over time, and a trend can be observed, and whether that trend is significantly different over the period 1996-2009 with explicit reference to the periods 1996-2007 and 2008-2009. As the stock weights-at-age are calculated as a running mean based on the observed weights-at-age in the Herring Acoustic Survey (HERAS), no further smoothing of the age-series was performed. Figure 3.2.1 shows the time series by age for the stock weights where Figure 3.2.2 shows the time series by cohort. An increase in weights-at-age for the year classes 3 to 6 can be observed in recent years (Figure 3.2.1). As the most recent year classes have not reached the older age groups yet, it is difficult to judge whether the more recent growth is different from the earlier year classes. Considering the younger age groups, no difference can be observed.

To test whether the growth in the most recent two years is significantly different from growth in the entire period, different models have been tested. First, a model describing the NULL hypothesis (no change in stock weight-at-age) was developed (model NULL). This model was fitted to each age time-series individually. This NULL hypothesis model was compared to a model which fits a linear relationship through the stock weights by year for each of the ages (model P1). An ANOVA was used to test if the model NULL and the model P1 were significantly different, which would indicate that a trend could be observed. Another model, defining two periods (1996-2007 period and the 2008-2009 period) was also defined (model P2), and is tested (using ANOVA) against the model P1 (in which the years 1996-2009 are treated as one period). If a significant difference is found, this indicates that there is a difference in growth in the more recent period. The data have been tested for autocorrelation; this indicated that no filtering was necessary.

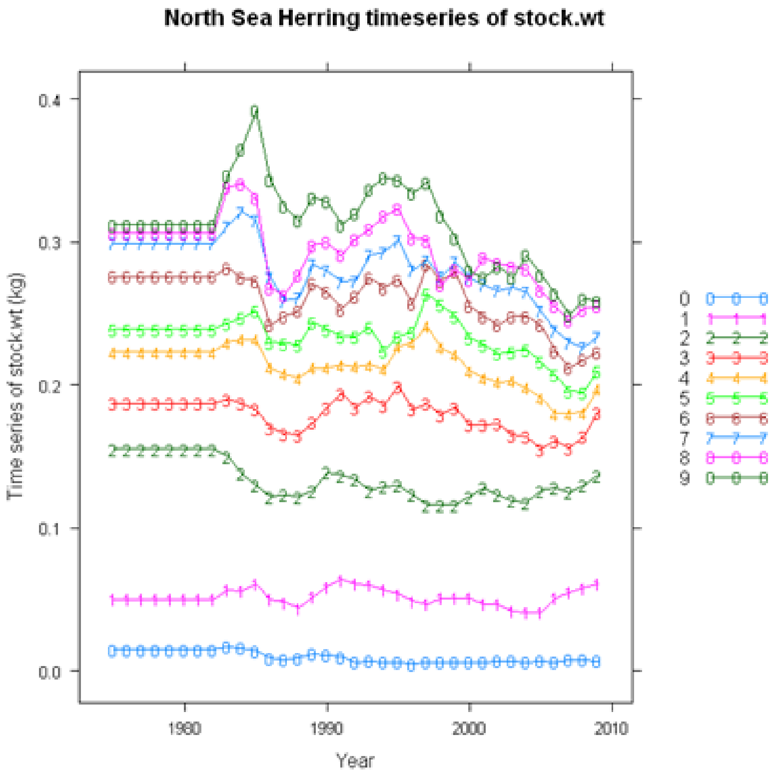


Figure 3.2.1: Time series of weight-at-age in the stock over the years. Ages are denoted by the legend. In the last 10 to 15 years, weight of North Sea herring has gone down for the older age groups (4-9), while being relatively stable for the younger age groups (0-3). In the most recent two years, in some age groups, weight-at-age has increased considerably.

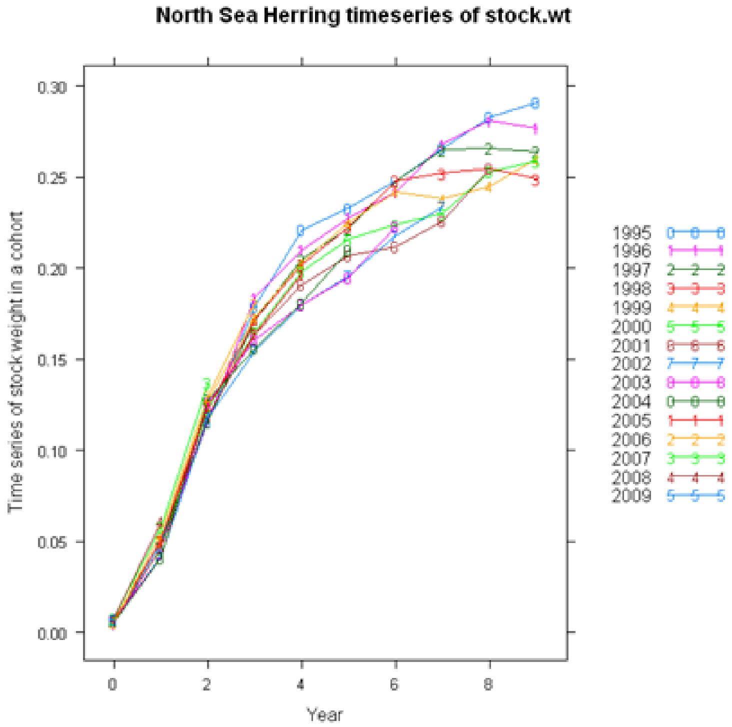


Figure 3.2.2: Time series of weight-at-age in a cohort. Cohorts are denoted by the legend. Hence, this figure follows the development of the weights-at-age of a year class. Not all year classes presented have reached the oldest age group already.

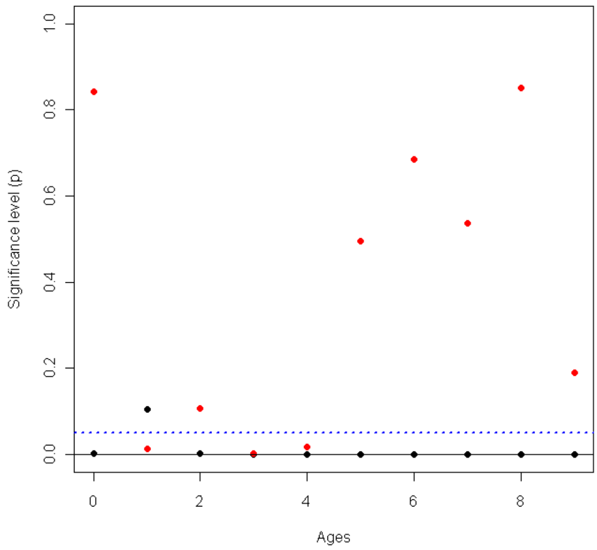


Figure 3.2.3: Results of the difference between the models NULL, P1 and P2. The blue dotted line indicates the significance level at which results were accepted to be significant (below blue dotted line). The black dots indicate whether a significant (y-axis) trend could be observed between the model NULL and the model P1 by age (x-axis). For almost all ages (except age 1) a significant trend in stock weight-at-age development can be observed. The red dots indicate whether a significant difference between the model P1 and P2 can be observed. For the ages 1, 3 and 4 a significant difference in stock weights at age development can be observed, while for all other ages, no significant difference in growth is visible. This indicates that the growth in the age groups 1, 3 and 4 is significantly different from the downward trends seen from 1996 to 2007.

Over the whole time series, for almost every age group, a significant (downward, see Figure 3.2.1) trend in weight-at-age can be observed. Due to the increase in growth in different age groups in the most recent two years, this trend is different from the almost continuous downward trend from 1996 to 2007. Hence, for mostly the younger age groups, growth in the most recent two years is significantly different (weight-at-age is increasing, see Figure 3.2.1). One should note, however, that in the WKHMP 2008 growth was expected to stabilise, not continue to decline. Additionally, a stochastic representation of weights-at-age has been taken into account within the LTMP evaluation where weights-at-age were randomly drawn from the years 2001-2006 (similar to a 6 year average mean weight-at-age). Hence, **weights-at-age as evaluated in the LTMP are very similar to the more recent weights-at-age as no further decline in weights-at-age have been observed, which would have violated the approximate assumption of 6-year average weight-at-age.**

3.3 Maturity

A similar exercise to that on growth (section 3.2) was performed for maturity-at-age development. Figure 3.3.1 indicates the time series of maturity-at-age for the ages 0-4 (as ages 5-9 have been constant over the full time series with full maturity). Figure 3.3.2 shows the time series of maturity-at-age in a cohort.

Both Figures 3.3.1 and 3.3.2 do not indicate any change in maturity-at-age in the most recent two years. The results of the models P1 and P2, including and excluding a period reference, are shown in Figure 3.3.3. **The analyses show that there is no significant trend in maturity. Additionally no difference in the most recent two years can be observed for most of the ages.**

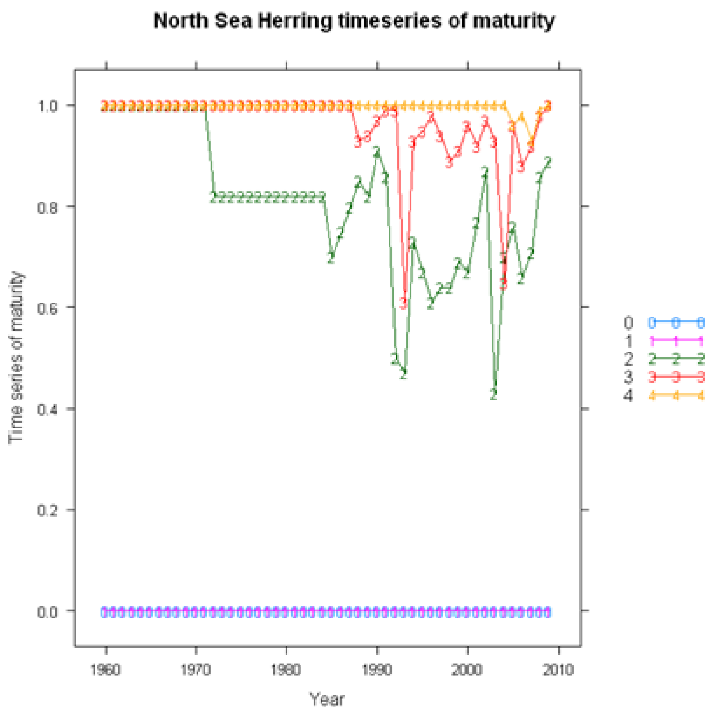


Figure 3.3.1. Time series of maturity-at-age in the stock over the years. Ages are denoted by the legend. In the last 10 to 15 years, maturity has fluctuated considerably for the ages 2 and 3. There is no trend and no difference in the recent two years.

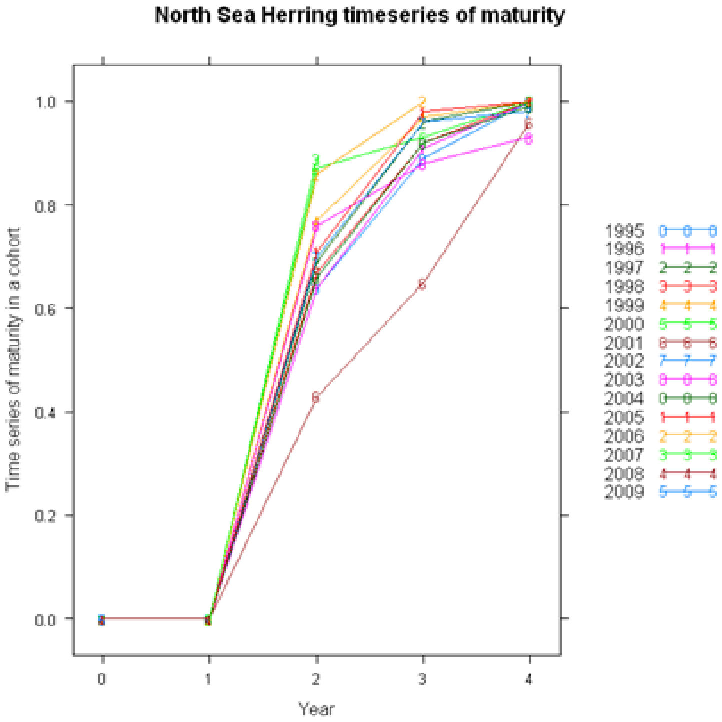


Figure 3.3.2. Time series of maturity-at-age in a cohort. Cohorts are denoted by the legend. Hence, this figure follows the development of the maturity-at-age of a year class. Not all year classes presented have reached the oldest age group already.

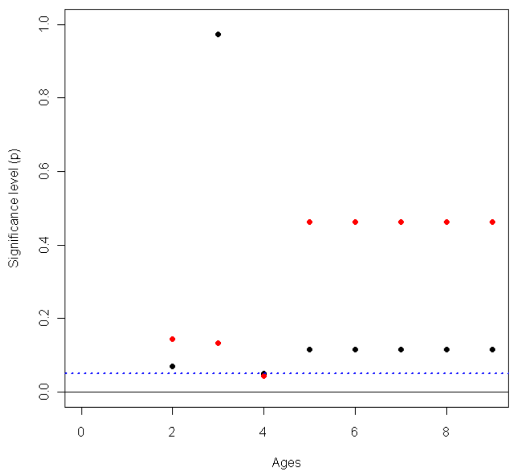


Figure 3.3.3. Results of the difference between the models NULL, P1 and P2 using the maturity data. The blue dotted line indicates the significance level at which results were accepted to be significant (below blue dotted line). The black dots indicate whether a significant (y-axis) trend could be observed between the model NULL and the model P1 by age (x-axis). No significant trends can be observed for the entire time-series (1996-2009), as is indicated by the black dots. The red dots indicate whether a significant difference between the model P1 and P2 can be observed. Only for age 4, a significant difference in maturity-at-age development can be observed. This indicates that the maturity-at-age 4 is significantly different from the slight downward trends seen from 2004 to 2007 (but taking the full time series into account).

3.4 Migration

The distribution of North Sea herring from surveys and catch distribution in the recent years (2003-2009) was investigated to identify shifts in migration pattern after 2007 (Figure 3.4.1).

Adult herring mapped in the acoustic survey show a slight shift in the main summer aggregation off Scotland, from a northern cluster centred close to the 4°E longitude to a more easterly centred aggregation. This may have implications resulting in reduced mixing in catches of North Sea and 4aWest herring.

Similar acoustic maps of juvenile herring summer aggregations have a much more variable distribution among years. A possible trend could be that coastal southern aggregations along the UK as well as in the German Bight seem to be replaced by more northern scattered clusters.

On the other hand the overall distribution of annual catches by ICES statistical rectangles has a very similar pattern in all years. On a smaller scale there appears to be an increasing variation within year among ICES statistical rectangles, with fewer rectangles providing higher proportions of the catches.

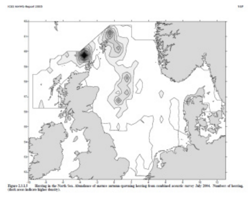
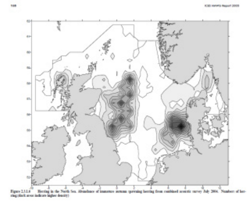
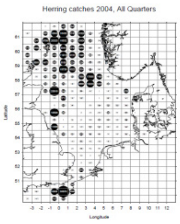
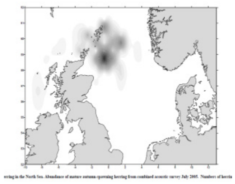
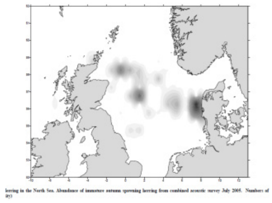
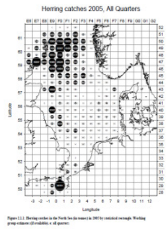
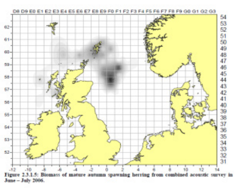
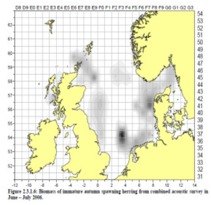
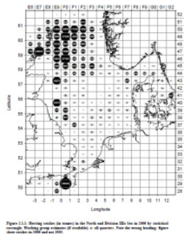
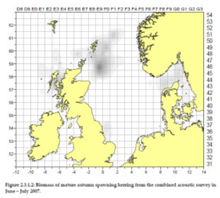
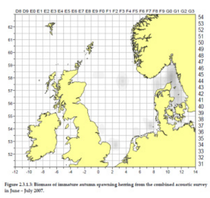
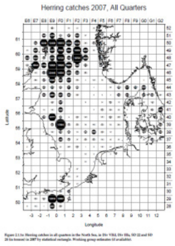
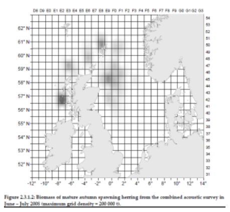
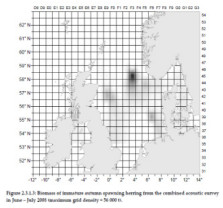
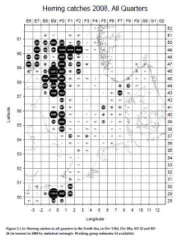
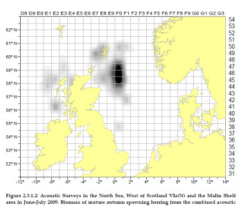
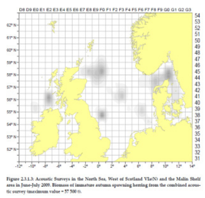
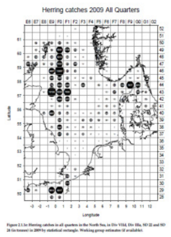
			2004
			2005
			2006
			2007
			2008
			2009
Mature herring distribution in summer acoustic surveys	Juvenile herring distribution in summer acoustic surveys	Yearly catch distribution by ICES statistical rectangles	

Figure 3.4.1. Distribution of herring 2004- 2009 in the summer acoustic survey (adults and juveniles) and in the catch.

3.5 Exploitation

There have been several changes in the fisheries over the past decade, the most substantive ones in the Danish fishing fleet. The revision of the management plan in 2008 reduced the fishing mortality limit for bycatch of herring in industrial fisheries. Although mortality on 0-1 ringers had already been around that level for a decade (average of F=0.059 over the period 1997-2008), from 2009 onwards the value of F=0.05 presented an absolute and stricter limit, resulting in a closure of the industrial fishery if exceeded. In other words, a considerable incentive was introduced to the industry to minimise juvenile mortality by substantially reducing herring bycatches in the industrial fisheries (predominantly sprat), to reduce the risk of having to close all fisheries with mesh sizes less than 32 mm.

Two years previously, in 2007, the Danish administrations introduced an ITQ system to regulate industrial fisheries. This has led to a consolidation of the fleet, resulting in fewer vessels being active. Due to this restructuring of the fleet, pelagic vessels that earlier did not take part in industrial fisheries have now became heavily engaged, while previously, the human consumption fleet and industrial fleet had been mostly separate. This allowed vessel owners to be more flexible in weighing the benefits of one fishery against the other, but also put them in a position of being more exposed to the risk of sanctions against them in terms of losing 1/12 of their human consumption quota when not complying with the maximum limits of the amount of herring bycatch that they are allowed to hold on board.

Another change in the NSAS herring fishery was the substantial decline in misreporting of catch. Area misreporting (from IV to VI; and from IV into IIIa) seems to have ceased. Most of the previous unaccounted catches from the stock have been reduced, if not eliminated. Part of this can be explained by newly introduced national legislation in Denmark in 2009.

Lastly, the Scottish industry had the impression that the fisheries for Matjes herring was being conducted further west in recent years (the fishery for smaller herring in late May and June specifically for the Dutch market). Scottish vessels had been involved in the Matjes fishery for some 15 years, but recently (since 2005) the abundance of the correctly-sized herring in their waters had increased so much that they became very easy to catch. According to LUNAR (the only processor for Matjes herring in Scotland), the total amount of herring landed by Scottish vessels for Matjes has been between 1500 and 2000 tons annually.

Thus WKHERMP was aware of changes in the fishing behaviour but these do not affect the performance of the management plan. However, they may have an impact on the assessment (see next paragraph).

3.6 Quality of advice to populate the management plan

The assessment of North Sea herring has performed well for a number of years, with retrospective changes in the main parameters mostly well below 10% (Simmonds, 2009). In 2010, however, the biomass increased far more than projected. The 2006 year class (2 wr in 2009) was estimated to be 75% greater in abundance than estimated in 2009. It was also more mature than projected (89% compared to 74% mature). The adjustment to other year classes was small. These factors, plus increased size-at-age, resulted in a difference of 316 kt SSB compared to the projected estimate from HAWG 2009. However this change was just at the bounds of the 30% model precision (see HAWG 2011).

The information that populates the assessment is: the catches in numbers-at-age; the MIK survey for age 0 (now called IBTS 0); the IBTS survey for ages 1-5; the acoustic survey for ages 1-9. There is also a larval index informing on the SSB. In the stock assessment model (FLICA), the catch data are related to stock abundance by assuming a separable model for the fishing mortality in the recent period.

A detailed examination of the data that led to the estimate of the 2006 year class, shows that the low estimate in previous assessments was mostly determined by low catches at ages 0- and 1-ring; these may be due to the changes described in Section 3.5. At age 2, this year class was better represented in the fishery. That led to a perception of a higher abundance of that year class in 2009, and the effect propagates backwards in time to lift the estimates of that year class also at earlier ages. The survey information was somewhat conflicting, but could be compatible with both alternatives.

In addition, data obtained from catches in the industrial fleet which are used to re-estimate year class strength in retrospect, may have become more uncertain due to the fact that samples are taken from a fishery that is developing towards smaller catches (see Table 3.5.1).

Table 3.5.1. Catches of herring and sprat in the Danish sprat fishery (2005-2010).

Year	Bycatch of herring (t)	Proportion herring/sprat	Sprat catches (t)	Exploitation of sprat quota
2005	22 205	10.3%	216 238	92.9 %
2006	12 057	10.4%	115 657	81.4 %
2007	6 749	8.4%	80 233	51.7 %
2008	8 822	13.1%	67 106	48.6 %
2009	9 813	8.2%	118 960	86.7 %
2010	9 168	7.4%	124 481	92.1 %

There are also indications that the catches of the 2006 year class were influenced by changes in the fishery. Firstly, the reduction of fishing mortality in the juveniles (0-1 ringers) fishery due to the introduction of ITQs in the Danish industrial fishery in 2007 (Section 3.5) and the amendment of the management plan in 2008, may partly explain the necessity to change the year class strength estimate. Secondly, the appearance of higher concentrations of herring of the Matjes quality near the Scottish coast may trigger an increased exploitation of 2-ringers. Although information from the industry shows that the currently landed quantities are negligible, if this indicates a trend, then the impact of this fishery on the catches of 2-ringers should be explored further because it may affect the assessment as the assumption of separable fishing mortality will be violated. This would make the catch data for 0- and 1-ringers less valuable as an indicator of the abundance of the year classes that will reatly influence the predictions. The estimates of the abundance of these year classes will then be more dependent on survey information. Most often, survey data are consistent and appear reliable, but there are some exceptions. Altogether, this development in the fishery may render the assessment less certain. This issue should, in addition, be placed in a wider context, by investigating if the total of fisheries for this particular market is changing, or whether increased landings by Scottish vessels merely represents a geographical shift. This could not be investigated during this meeting.

Thus WKHERMP considered that the quality of the stock assessment may have changed in recent years. This could have implications in terms of understanding

the signal to noise ratio and how the quality of the assessments is incorporated into simulations of the management plan. This should be addressed by HAWG.

4 The Objectives of the Management Plan

In order to provide an appropriate response to ToR a (the evaluation of the performance of the plan), the objectives of the plan should be clearly defined. The preamble in the EU-Norway agreement stipulates that the implemented management plan should be "consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields". From this, the workshop considered 4 separate objectives in relation to evaluating the performance of the plan:

1. Consistency with the Precautionary Approach
2. A rational exploitation pattern
3. Stable yield
4. High yield

It is noted that all of these objectives can be interpreted in various ways. In addition, there is no specific indication of the hierarchy of these management objectives. Knowledge of the order of importance is relevant when considering trade-offs between the management objectives.

5 Evaluation of the performance of the plan

5.1 Consistency with the Precautionary Approach

When, a decade ago, recruitment levels fell to approximately half of the long term average, there was a need to reduce exploitation substantially, in order to avoid SSB falling below B_{lim}. Despite the fact that the 15% IAV rule limited response to this biological change initially, the framework ultimately allowed sufficient response to ensure consistency with the PA, because paragraph 6 (providing a derogation to the 15% rule) was invoked. While SSB started to decline in 2004, it remained well above B_{lim}, reaching its lowest level in 2008 at 1.0 million tonnes. In recent years, F was also below F_{pa} (see section 6 below). In 2008, WKHMP considered the management plan consistent with PA. Since 2008, the management plan has resulted in fisheries management that conformed to, and was consistent with, the PA.

5.2 A rational exploitation pattern

There are no specific indications in the EU-Norway agreement on how to interpret this objective. WKHERMP considered the following interpretation:

To achieve a fair balance in the trade-off between the needs of different fleet segments – i.e. human consumption versus industrial fleet.

Reducing the fishing mortality on the juveniles gives better fishing opportunities on the adults, with one tonne of juvenile catch "costing" approximately 2-3 tonnes of adult catch. Recent developments have been in the direction of minimising mortality on 0-1 ringers, which from a conservational perspective – as well as from a perspective of aiming for high long term yields - would be regarded as "rational". Currently, mortality on 0-1 ringers is no higher than what is unavoidable due to bycatch in other fisheries and much lower than estimates of natural mortality. Thus WKHERMP evaluates that the current management plan has resulted in a rational exploitation pattern.

5.3 Stable and High Yield

The combined objective of stable and high yield implies a trade-off between stability and high yield. The preference has not been explicitly stated. Fluctuations in TAC may be caused by changes in biology and populations dynamics, but may also be due to unwanted effects of uncertainty and inconsistent assessments. A rule that allows no more than 15% change in TAC from year to year has been in effect since 2004, with the purpose to prevent undue fluctuations in the TAC.

Historically, both with the increase in the stock due to the good recruitment in 2000, and the decline in the stock due to the subsequent reduction in recruitment, the harvest rule (without a 15% constraint on TAC change) led to fishing mortalities broadly in line with the target, over the longer term. In that sense, the fluctuations in the stock were adequately handled by the harvest rule (including the change in trigger biomass in 2008), but in these cases primarily due to deviations from the 15% rule. In the first case, the 15% rule had not been introduced. If it had been in effect, it would have led to a much slower increase in the TAC when the 2000 year class came in. In the second case, the reduction could be made because of the exception rule (paragraph 6 in the agreement).

WKHMP 2008 outlined several alternatives for harvest rules, with different breakpoints and different target fishing mortalities. The agreed harvest rule implies a higher target fishing mortality which allows a stronger increase in the catches if the stock improves. The choice of a high breakpoint, however, has the effect that variations in the assessment are amplified when translated into TACs, because the SSB is expected to be mostly in the range of stock sizes where the harvest rule defines fishing mortality with the sloped line, meaning that a small change in SSB prescribes a changed F as well. With the harvest rule suggested as another option by WKHMP, a lower target F and lower trigger biomass, it could be expected that SSB would be above the trigger biomass more often, leading to TAC setting based on the target F more consistently, resulting in more stable TACs. The choice by managers – which was supported by stakeholders – for the currently the agreed harvest rule suggests a preference for high yield over stability.

In 2010, fishing mortality derived from the harvest rule (disregarding the 15% constraint) suggested setting a considerably higher TAC then the 15% constraint would allow. This may partly be due to improvement in the stock abundance, which is expected with a reduced fishing mortality, but there may also be an element of assessment uncertainty. As with most '15% rules', the agreed management plan has an exception if the stock falls below some breakpoint. This may lead to an unwanted asymmetry in the response to fluctuations in the stock. If the stock is increasing from a low level, or an assessment underestimate is corrected, it will take several years to get a low TAC up to the level corresponding to the target fishing mortality, while a drastic decrease in TAC can be implemented immediately. Therefore, the preference for high yield over stability is to some extent counteracted by the 15% rule, but only in situations where the stock is improving.

In conclusion, the management plan has performed well in terms of avoiding B_{lim} and, except in the most recent years, in providing catches not higher than the level corresponding to the target fishing mortality, at the sacrifice of stability. However, this would not have been the case if the 15% rule had been practised consistently. The main problem is that the 15% rule does not cope satisfactorily when there is a large and rapid increase in the stock abundance. A large decrease is handled by the exception rule (paragraph 6) and with small fluctuations it hardly comes into effect.

Thus WKHERMP considers that in terms of stable and high yield, the current management plan does not clearly state the preferred trade-off. Without the 15% IAV limit on TACs, in practice the management plan favours high yield. The intention of the 15% IAV in the management plan is to favour stability to the detriment of high yield.

5.4 Conclusion to evaluation of performance

The management plan appears to operate well in relation to the first two objectives (as interpreted by WKHERMP), but not in relation to achieving stable and high yield. The main weakness appears to be the 15% IAV limit on TAC change which leads to unnecessarily restricted TACs when the stock is improving.

6 Precautionary reference points

WKHERMP considers that F_{pa} has been addressed at length in the past. The management plan does not consider F_{pa} in its formulation. The quota setting in the management plan leads to the formulation of a target F dependent on different levels of SSB. This target F agrees well with the analysis of FMSY. Thus WKHERMP will not comment further on F_{pa}.

Early analysis, based on extensive simulations (Patterson et al., 1997), determined the level of sustainable exploitation of adults and juveniles that resulted in a low risk of bringing SSB below 800 000 tonnes, which was the MBAL at the time (Minimum Biological Acceptable Levels). The trigger biomass (1.3 MT) was decided mainly on political grounds, but it was also thought to give protection against falling below the MBAL. The value of B_{pa} itself was politically and not scientifically determined (ICES, 1998). However, in the intervening period WKHERMP feels that it has done a good job of keeping the SSB away from B_{lim} in its use as a break point in reducing F. The management plan has shifted the biomass break point to 1.5 million tonnes and the B_{pa} is therefore no longer considered. However, although the set value has not been reanalysed to reflect the present data rich situation it is still used to flag if the stock is fished within safe biological limits. ICES has evaluated the management plan and considers it as precautionary because it keeps SSB well away from B_{lim}. Where SSB is below B_{pa} but within the bounds of the management plan, B_{pa} is therefore in conflict with the management plan

WKHERMP recommends that a scientific analysis of B_{pa} should be carried out. Although it is no longer used for management considerations nor part of the management plan, B_{pa} is widely used in the classification of the stock status thus it is important to the industry.

7 The MSY approach for the stock

The European Union has subscribed to the MSY approach by adopting a specific MSY policy that aims to adjust fishing mortalities to the levels corresponding to MSY by 2015. As a result, ICES is currently developing a strategy for the transition of the current precautionary-based advice to an MSY framework. The ICES MSY framework adopted in 2009 represents a change in the ICES advice philosophy as the precautionary advice strives at avoiding an undesired outcome, impaired recruitment, while the MSY framework aims at achieving a desired outcome, a high, sustainable long term yield. However, according to ICES, the MSY framework is usually consistent with the precautionary approach as well as national and international policies and agreements. It should, according to ICES, result in lower fishing mortality rates, and in the long term larger stock sizes and higher catches than the ICES precautionary approach framework.

The North Sea herring harvest control rule (HCR) within the long term management plan suggests F2-6 of 0.25 when the SSB is estimated to be above 1.5 million tonnes. Similarly, F0-1 is suggested at 0.05 when the SSB is estimated to be above 0.8 million tonnes. However, in the transition to an FMSY approach, it is relevant to understand whether the current harvest control rule is also regarded consistent with the MSY approach.

Over the past years, different simulations have been executed to evaluate whether the current HCR is consistent with the MSY approach. HAWG conducted medium term simulations using the HCS10 software in 2010 (HAWG 2010). HCS10 is a medium term projection program designed for exploring harvest control rules, but was used here to illustrate the stochastic equilibrium in yield at a range of fixed levels of realized F resulting from variability in recruitment and growth. This approach was later incorporated in the work of WKFRAME-2. The range of F2-6 values considered as being appropriate, and therefore consistent with the MSY approach as well, are close to 0.25. However, values for 0-1-ringers were not explicitly considered in these simulations.

Piet et al. (submitted) explored the MSY concept of, among others, North Sea herring under different assumptions of stock recruitment and natural mortality scenarios. The authors suggest that FMSY for ages 2-6 should lie between 0.25 and 0.45. Skagen (2010) performed a similar study also based on yield curves and stock recruitment functioning. Interpretation of the results suggests a FMSY level of 0.25. The first WKFRAME workshop explored the concept of FMSY under a number of different stock-recruitment approaches also limiting the time series to include the more recent poor year classes only. It concluded that the results are sensitive to recruitment assumptions but the management plan seems to be appropriate for recent recruitment. Within these studies, the fishing mortality on 0-1 ringers was not explicitly taken into account or related to the FMSY approach for the 2-6 ringers.

Since 1997, the year after the implementation of the herring long term management plan, juvenile fishing mortality on the 0-1 ringers reduced considerably. Simulations made by WKHMP 2008 showed that a closure of the juvenile fishery corresponds approximately to an increase in FMSY on the 2-6 ringers of the same amount of the reduction in F0-1 reduction, i.e. 0.05. Therefore, in theory the F2-6 in the LTMP could be increased to 0.30 if the juvenile fishery is terminated. As a complete termination of herring bycatch is unlikely, the current F2-6 target is consistent with the MSY approach, with the low F on juveniles.

In conclusion, the current F2-6 of 0.25 is consistent with the MSY approach under the current low recruitment regime. The management plan is also considered consistent with the MSY approach.

8 Effect of low recruitment

The changes to the harvest control rule in 2008 were primarily made to adjust the management plan to account for the greater risk to SSB falling below 800 000 tonnes caused by the lower recruitment since the 2001 year class (as estimated in 2007). This was based on the extensive simulations carried out by WKHMP 2008. WKHERMP concludes that for the most recent three year classes there is no evidence that recruitment has either increased or decreased (see section 3.1) and that there is no reason therefore to change the assumption that NS herring recruitment is still in the current low productivity phase.

Thus as the management plan has already been adjusted (in 2008) to account for the lower productive regime since the 2001 year class and there has been no observed change to the pattern of recruitment, **WKHERMP suggests that there is no basis to further adjust the harvest control rule to account for changes in recruitment.** WKHERMP also emphasises that that the exploitation rate prescribed by the management plan (with the 1.5 million tonne trigger point) is consistent with sustainable exploitation of North Sea herring in the current productivity regime of low recruitment. In recent years, the catches were reduced greatly and now exploitation is proportionally much lower. Thus WKHERMP does not predict the SSB to decrease further as a result of the low recruitment regime since 2001.

9 Is within-year revision consistent with the objectives of the LTMP?

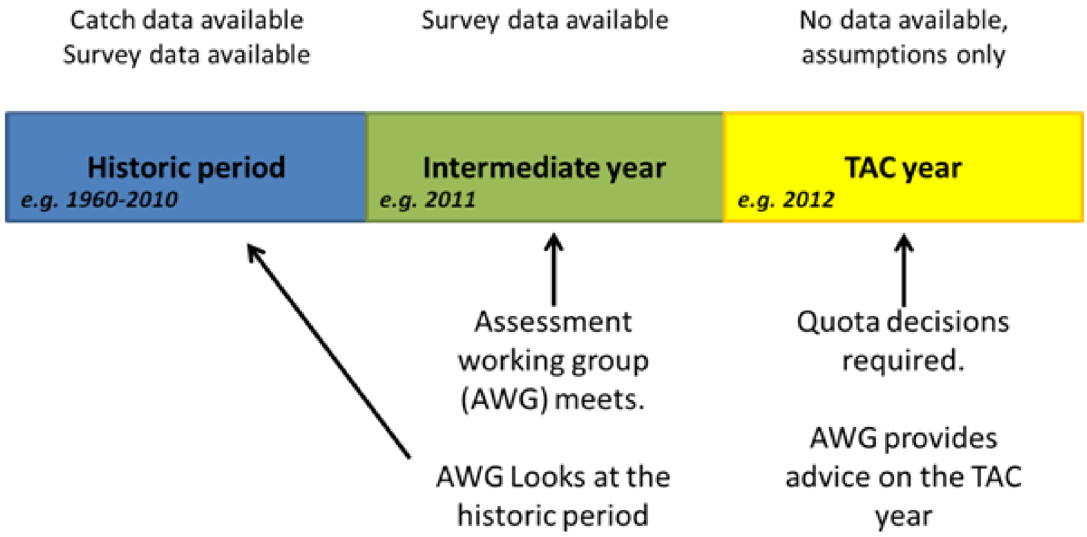
This ToR received a lot of attention from WKHERMP.

Stakeholders indicated that they were in favour of investigating alternative amendments to the management plan that would improve its performance in terms of ensuring high yield, also in exceptional circumstances such as the one mentioned here. The general opinion was that when the rule is seen to not work, it is time to change the rule, rather than developing approaches for within-year revision.

Stakeholders present at the WKHERMP indicated that although the Pelagic RAC had advised to investigate the issue of within-year revision in 2010, industry was generally not in favour of these revisions, because it hampered their effective planning of the fisheries at the beginning of the year. When the Pelagic RAC had advised within-year revision in 2010, it had viewed it as a possible one-off measure, when industry felt that rigid application of the management plan would fail to ensure maximum yield within sustainability limits.

WKHERMP considered that there were a number of methodological and practical obstacles to including within-year revisions to the TAC, to deal with issues like the exceptional increase in SSB in 2010.

The short term forecast used for North Sea herring can be divided into three periods (see panel below): the historic period, including the most recent year in which stock assessment model is available; the intermediate year, most often the year for which a TAC has been negotiated but has not been fully exploited; the future period (TAC year in the panel below), for which the dynamics completely rely on assumptions of the system.



TAC options do not play a role in the historic period, as catches have already been taken. In the intermediate year, however, deviations from the negotiated TAC are possible and will alter the starting conditions for the advice which, in the case of North Sea herring, is based on the long term management plan. This is because the advice is based on assumptions of catch in the intermediate year (including any TAC overshoot). Within the most recent evaluation of the LTMP in 2008, a TAC overshoot of 10% was assumed, and was found to be precautionary under these conditions. Within the advisory process of ICES to the European Commission, the Herring Assessment Working Group (HAWG) occasionally takes a TAC overshoot into account in the intermediate year as well. However, from 2010 onwards no overshoot is assumed within the intermediate year.

A within-year revision of the TAC, then, will alter the assumption of the TAC usage in the intermediate year, which directly affects the advice that would be agreed within the ICES advisory process (in the "before year" advisory round) by introducing an additional source of uncertainty. In addition, evaluating such a within-year revision in a long term management plan is not possible. The long term management plan assumes unbiased, (but imprecise) knowledge of the system. SSB revisions such as those observed in 2010 cannot be simulated within a long term management plan evaluation other than increasing the source of assessment uncertainty, which would work two ways, incorporating uncertainty for upward and downward revisions.

Under the assumption that the source of uncertainty has increased over the recent years, the precautionary level of the LTMP might form a point of discussion. In the light of stability in TACs, a within-year revision would not follow the 15% IAV rule and hence would not contribute to stability. Higher yields will however be possible when incorporating the structure of within-year revisions when the stock is showing a clear increase.

In addition, within-year revision could result in management responding to noise in the biological signal rather than the signal itself.

ICES' general approach is for scientists in the expert group to produce a draft form of advice. This is then taken to an advice drafting group where the advice is formalised and presented to ACOM where it is accepted as the official ICES scientific advice. Within-year revision requests would generally be made after the official advice has been published. There is no mechanism within ICES to return to the stock experts for their input to what is generally a collegiate approach.

In conclusion, **WKHERMP felt that it is better to have a management plan that is able to be responsive to large changes in the biology of the stock than to develop mechanisms for within-year revisions.**

10 The way forward- potential adjustments to the management plan

The main unsatisfactory issue with the current management plan is the performance of the 15% rule to constrain year-to-year fluctuations in the TACs. **WKHERMP suggests that the management plan is revisited in 2011, prior to the December decisions by the EU and Norway, to develop arrangements that avoid the unwanted side effects of the present plan**. This should be done as a collaborative iterative process between scientists, managers and stakeholders. To facilitate the process, it would be useful if the trade-off between the objectives of stability and long term yield could be expressed more clearly. It will thus not be possible to do this work at the 2011 herring assessment working group.

The main tool for the process should be simulations to illustrate likely performance of various options for stabilizing the TACs. Simulations should show performance in terms of long term yield and inter-annual variation in TACs in addition to risk. Such simulations can be done to a large extent by amending the software that was used by WKHMP 2008. Further analyses of the most promising options should ideally be done with software that better simulates the assessment errors, although that may require substantial programming, and may need to be altered after the benchmark assessment in 2012.

WKHERMP was not in the position to suggest one specific solution to this problem. Rather, it would suggest that a broad range of options be explored, after clarification of the objectives and priorities of the LTMP from managers. These include:

- The present rule, but without exception of the 15% constraint.
- An investigation of TAC limitation criteria. An xx% rule (not only 15%) with a range of SSB estimates below which the rules would not apply, and with a range of target fishing mortalities and trigger levels for reducing fishing mortality.
- Different criteria for applying the constraint, for example, apply the constraint only if the SSB has been above some level for 2 or more years.
- Setting the TAC as a weighted average of the projected value according to a target F and the previous TACs, as practised for Icelandic cod or other smoothing mechanisms, such as used for western horse mackerel.

The work should be completed in time for ACOM to advise on a revised rule by October 2011.

11 Conclusions

WKHERMP found no substantive changes to the biology or ecology of herring to suggest that the simulations from WKHMP 2008 were no longer applicable (recruitment, growth, maturity, migrations). Although the fishing behaviour of some fleets may have recently altered, these potential changes were judged unlikely to impact on other aspects of the management plan. The quality of the stock assessment may have changed in recent years. This change in quality could have implications in terms of understanding the signal to noise ratio from the assessment and the functioning of the simulations of the management plan.

ToR a). The management plan appears to operate well in relation to the objectives of consistency with the precautionary approach and a rational exploitation pattern, but not in relation to achieving stable and high yield. The main weakness appears to be the 15% IAV limit on TAC change which leads to unnecessarily restricted TACs when the stock is improving.

ToR b) A scientific analysis of Bpa should be carried out. Although it is no longer used for management considerations nor part of the management plan, Bpa is widely used in the classification of the stock status thus it is important to the industry.

ToR c) The current $F_{2\text{-}6}$ of 0.25 is consistent with the MSY approach under the current low recruitment regime. The management plan is also considered consistent with the MSY approach, although the trade-off between stability and high yield will limit the maximising of yield in some circumstances.

ToR d) there is no basis to further adjust the harvest control rule to account for recruitment variability or trends.

ToR e) it is better to have a management plan that is able to be responsive to large changes in the biology of the stock, or assessment uncertainty, through other mechanisms than within-year revisions.

WKHERMP suggests that further work on the management plan be carried out in 2011, prior to the December decisions by the EU and Norway, to develop mechanisms that avoid the unwanted side-effects of the present plan. This work cannot be carried out during the 2011 herring assessment working group.

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13 Annex 1 Terms of Reference of WKHERMP

2010/2/ACOM54 **Workshop on the evaluation of the long term management plan for North Sea herring (WKHERMP)**, chaired by Mark Dickey-Collas (NL), will meet at ICES headquarters 14–15 March to:

a) Evaluate the performance of the plan in meeting its objectives, identifying any weaknesses in design or implementation that undermine its effectiveness;

b) Evaluate whether the values assigned to the precautionary reference points remain appropriate;

c) Indicate whether the target fishing mortalities rate of 0.25 for the 2-ringers and older and no more than 0.05 for 0-1-ringers, are consistent with MSY for the stock;

d) Indicate any adjustments that should be made to harvest control rules to take into account recent low levels of recruitment.

e) In view of exceptional increase in the estimated SSB in 2010, to comment on whether an in-year revision of the TAC in similar circumstances is consistent with the objectives of the LTMP.

The Workshop is set up in response to an EU/Norway request and stakeholders will be invited to participate. An analysis will follow in the HAWG meeting 16–24 March

WKHERMP will report by 4 April 2011 for the attention of ACOM.

14 Annex 2. Joint EU/Norway request to ICES.

DET KONGELIGE
FISKERI- OG KYSTDEPARTEMENT

Royal Ministry of Fisheries and Coastal Affairs

International Council for the Exploration of the Sea
H.C Andersens Boulevard 44-46
DK-1553 Copenhagen V

Your ref. Our ref. 201000722- /GER Date 17 JAN. 2011

Request to ICES by Norway and the European Union

Reference is made to the Agreed Record of Fisheries Consultations between Norway and the European Union for 2011.

According to Annex IX the Parties agreed to forward a joint request to ICES regarding evaluation of the long-term management plan for North Sea herring (enclosed).

We kindly ask for a response no later than 30 June 2011.

Yours sincerely,

Ann Kristin Westberg
Deputy Director General

Geir Ervik
Senior Advisor

Copy: European Commission, DG Mare, Mr. John Spencer

JOINT EU-NORWAY REQUEST ON THE EVALUATION OF THE LONG-TERM MANAGEMENT PLAN FOR HERRING

The objectives of the long-term management plan for herring of North Sea origin and allocation of catches agreed between Norway and the European Union is to provide for sustainable fisheries with high and stable yields in conformity with the precautionary approach.

ICES is requested by 30 June 2011:

1. To evaluate the performance of the plan in meeting its objectives, identifying any weaknesses in design or implementation that undermine its effectiveness;
2. To evaluate whether the values assigned to the precautionary reference points remain appropriate;

3. To indicate whether the target fishing mortalities rate of 0.25 for the 2-ringers and older and no more than 0.05 for 0-1-ringers, are consistent with MSY for the stock; and

4. To indicate any adjustments that should be made to harvest control rules to take into account recent low levels of recruitment.

5. In view of exceptional increase in the estimated SSB in 2010, to comment on whether an in-year revision of the TAC in similar circumstances is consistent with the objectives of the LTMP.

15 Annex 3. The current EU/Norway agreed Management Plan for North Sea autumn spawning herring.

According to the EU Norway agreement (November 2008):

The Parties agreed to continue to implement the management system for North Sea herring, which entered into force on 1 January 1998 and which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields. This system consists of the following

1. *Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 800,000 tonnes (Blim).*
2. *Where the SSB is estimated to be above 1.5 million tonnes the Parties agree to set quotas for the directed fishery and for bycatches in other fisheries, reflecting a fishing mortality rate of no more than 0.25 for 2 ringers and older and no more than 0.05 for 0 - 1 ringers.*
3. *Where the SSB is estimated to be below 1.5 million tonnes but above 800,000 tonnes, the Parties agree to set quotas for the direct fishery and for bycatches in other fisheries, reflecting a fishing mortality rate on 2 ringers and older equal to:*

    0.25-(0.15(1,500,000-SSB)/700,000) for 2 ringers and older,*

    and no more than 0.05 for 0 - 1 ringers
4. *Where the SSB is estimated to be below 800,000 tonnes the Parties agree to set quotas for the directed fishery and for bycatches in other fisheries, reflecting a fishing mortality rate of less than 0.1 for 2 ringers and older and of less than 0.04 for 0-1 ringers.*
5. *Where the rules in paragraphs 2 and 3 would lead to a TAC which deviates by more than 15 % from the TAC of the preceding year the parties shall fix a TAC that is no more than 15 % greater or 15 % less than the TAC of the preceding year.*
6. *Notwithstanding paragraph 5 the Parties may, where considered appropriate, reduce the TAC by more than 15 % compared to the TAC of the preceding year.*
7. *Bycatches of herring may only be landed in ports where adequate sampling schemes to effectively monitor the landings have been set up. All catches landed shall be deducted from the respective quotas set, and the fisheries shall be stopped immediately in the event that the quotas are exhausted.*

8 *The allocation of the TAC for the directed fishery for herring shall be 29 % to Norway and 71 % to the Community. The bycatch quota for herring shall be allocated to the Community.*

9. *A review of this arrangement shall take place no later than 31 December 2011.*
10. *This arrangement enters into force on 1 January 2009.*

16 Annex 4. Participants of WKHERMP

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